What goes around comes around: How large are spillbacks from US monetary policy?

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ESCoE Conference on Economic Measurement 2021
12 May 2021

Spillbacks from US monetary policy claimed to be large

"Actions taken by the Federal Reserve influence economic conditions abroad. Because these international effects in turn spill back on the evolution of the US economy, we cannot make sensible monetary policy choices without taking them into account" (Fischer, 2014)

"The Fed recognizes that its own policies have international spillovers, and because they affect global performance they are going to have spillbacks to US economic performance" (Yellen, 2019)

"AEs' monetary policies will increasingly need to take account of spillbacks" (Carney, 2019)

"There is much talk of 'headwinds' from EMEs buffeting AEs, [but these just] are the result of monetary policy actions taken some time ago by precisely those AEs" (Shin, 2015)

But...

This paper

- Quantify spillbacks from US monetary policy
- Counterfactual analysis in Bayesian proxy SVAR
  Arias et al. (2018, forthcoming)
  - Structural scenario analysis (SSA)
    Kilian and Lewis (2011); Bachmann and Sims (2012); Wong (2015); Epstein et al. (2019); Antolin-Diaz et al. (2021)
  - Minimum relative entropy (MRE)
    Cogley et al. (2005); Robertson et al. (2005); Giacomini and Ragusa (2014)
- Findings: Spillbacks from US monetary policy
  - account for almost 50% of the overall domestic US real activity effects
  - arise through stock market wealth/Tobin's q effects in US consumption and investment
  - arise more through AEs rather than EMEs (at least over 1990-2019)

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Outline

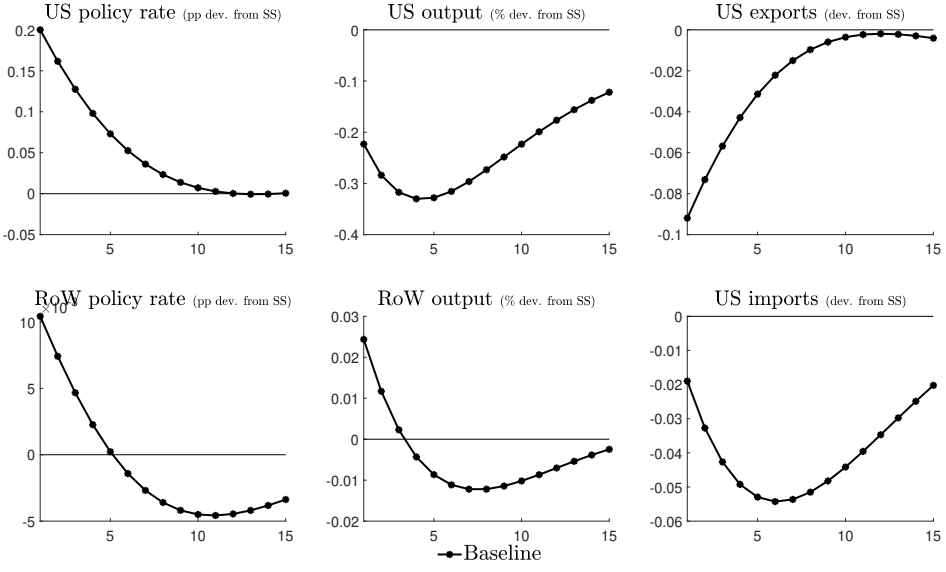
Spillbacks from US monetary policy: Conceptual considerations

Consider a standard—deliberately stylised—two-country NK DSGE model:

- US and RoW
- Trade in final goods
- Producer-currency pricing

Spillovers from US monetary policy materialise through net exports and RoW import prices.

IRFs to US monetary policy shock in two-country model



Spillbacks from US monetary policy: Conceptual considerations

Definition of spillbacks from US monetary policy shock:

	Unconstrained, **baseline IRF of US variable**
$-$	Constrained, **counterfactual IRF** of US variable
$=$	**Spillback**

What counterfactual model to consider?

- **Intuitive ♯1**: In the counterfactual spillovers shall be absent
- **Intuitive ♯2**: Raise home bias to unity

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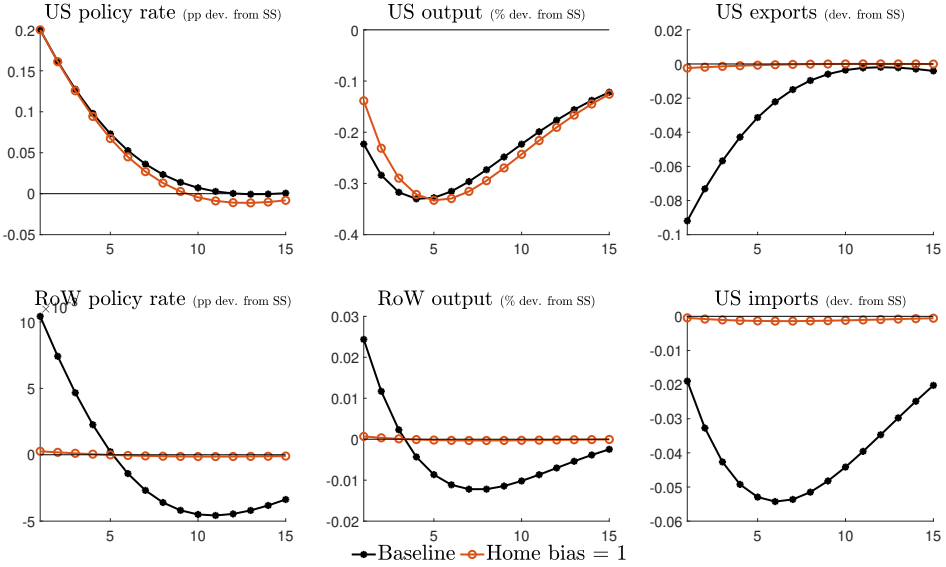

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- **Intuitive ♯2**: Raise home bias to unity
- **But**: Spillovers can be precluded in other, potentially equally intuitive ways
- **Intuitive ♯3**: Assume US is a small open economy

▸ No spillbacks with spillovers

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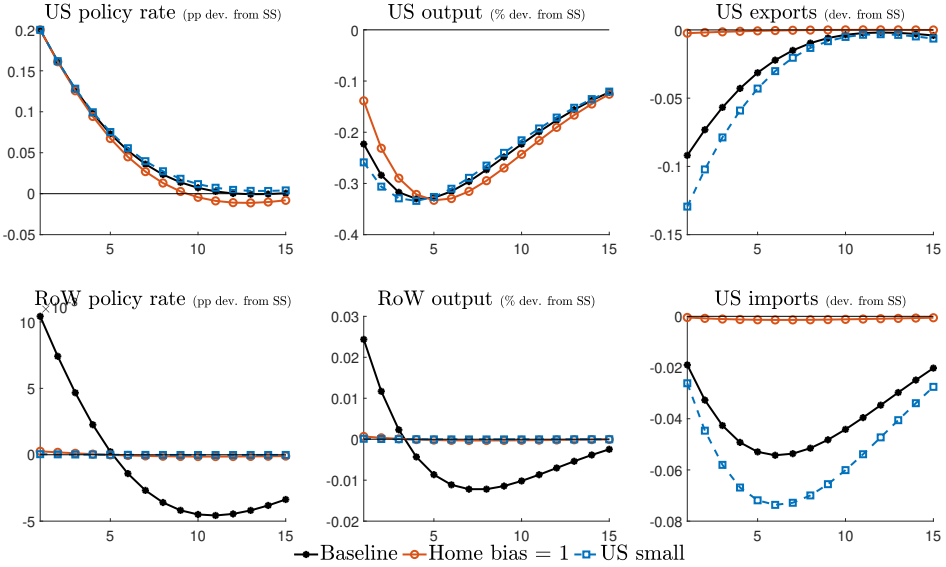

Spillbacks from US monetary policy: Conceptual considerations

Choice of counterfactual model not obvious from a theoretical perspective

No rigorous metric to guide selection of counterfactual model

We consider an entire set of counterfactual models in which

Spillovers from US monetary policy to RoW output are nil

Determining this set of counterfactual models is easier in a VAR framework

Empirical framework

Bayesian proxy SVAR of Arias et al. (forthcoming)

- Identification of multiple structural shocks with multiple proxy variables
- Additional shocks with sign, zero and magnitude restrictions

Identification by proxy variables and sign restrictions Details

- US monetary policy shock
  Gürkaynak et al. (2005); Gertler and Karadi (2015); Caldara and Herbst (2019); Jarocinski and Karadi (2020)
- Global uncertainty shock
  Piffer and Podstawski (2018)
- RoW 'depreciating'/'appreciating' shocks

Extend VAR specification of Gertler and Karadi (2015). Sample period: 1990m2 to 2019m6.

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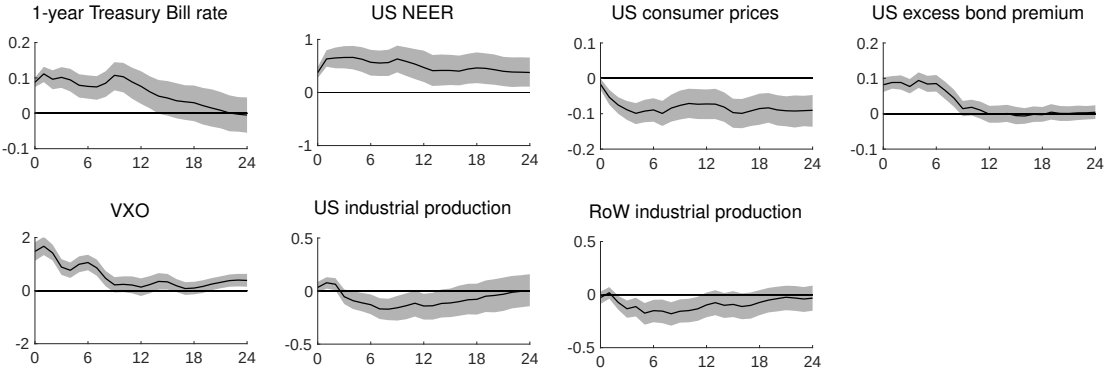
Baseline IRFs to US monetary policy shock



▸ IRFs to global uncertainty shock ▸ IRFs to RoW shocks ▸ Robustness

Assessing spillbacks from US monetary policy using counterfactuals

Counterfactual constraint: Output spillovers from US monetary policy to RoW are nil.

Imposing counterfactual constraint on RoW output IRF also modifies IRFs of remaining variables.

Two approaches to obtain counterfactual IRFs

- Structural scenario analysis: Use actual VAR model but add 'driving shocks'
  Kilian and Lewis (2011); Bachmann and Sims (2012); Wong (2015); Epstein et al. (2019); Antolin-Diaz et al. (2021)
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▸ SSA details ▸ MRE details

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Spillbacks to US industrial production based on SSA counterfactuals

- Counterfactual constraint enforced by ‘driving shocks’ that materialise along IRF horizon
- Use RoW appreciating/depreciating or all shocks
- Interpretation: Scenario in actual structural model

‘Driving shocks’ that enforce the counterfactual constraint on RoW output given by...

...only RoW shocks

...all shocks in the VAR

▸ Difference baseline/counterfactual ▸ Modesty statistic ▸ q-divergence

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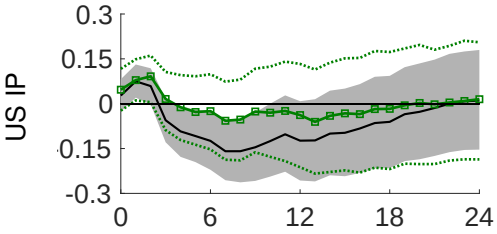

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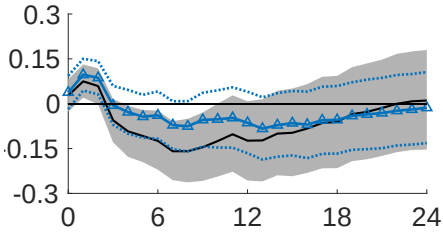

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Spillbacks to US industrial production based on MRE counterfactuals

- Determine alternative VAR model whose IRFs satisfy counterfactual constraint
- Disciplined by minimising entropy between actual and counterfactual VAR model posteriors
- Interpretation: Counterfactual world with alternative structural model

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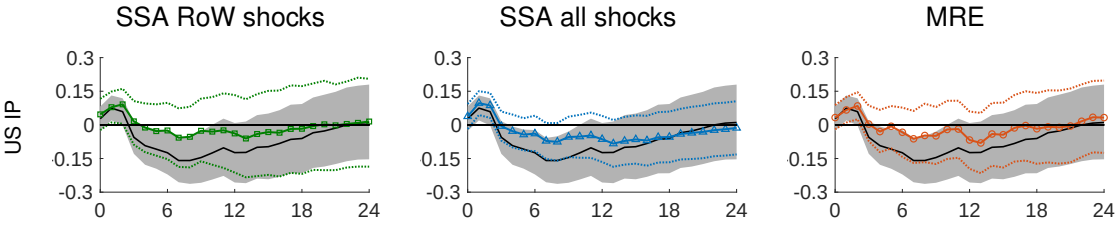
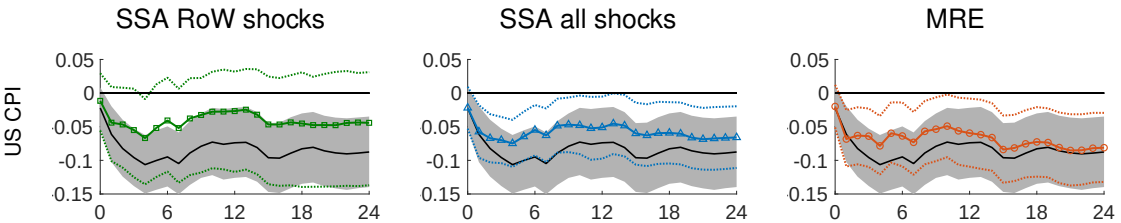
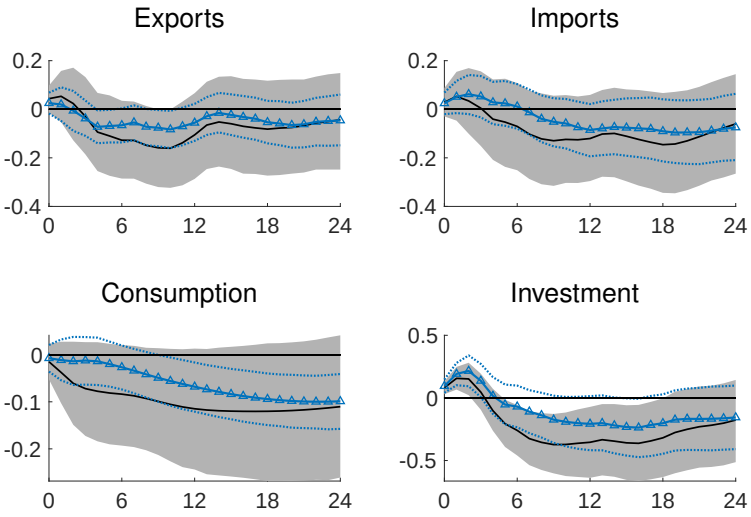


Results for spillbacks to US consumer prices



US net exports do not matter, but consumption and investment do



How do spillbacks to US consumption and investment arise?

Candidate channels/mechanisms

- Weaker tightening of US financial conditions
- Faster loosening of US monetary policy
- Weaker decline (increase) in US consumer/business confidence or uncertainty
- Weaker negative stock market wealth/Tobin's q effects

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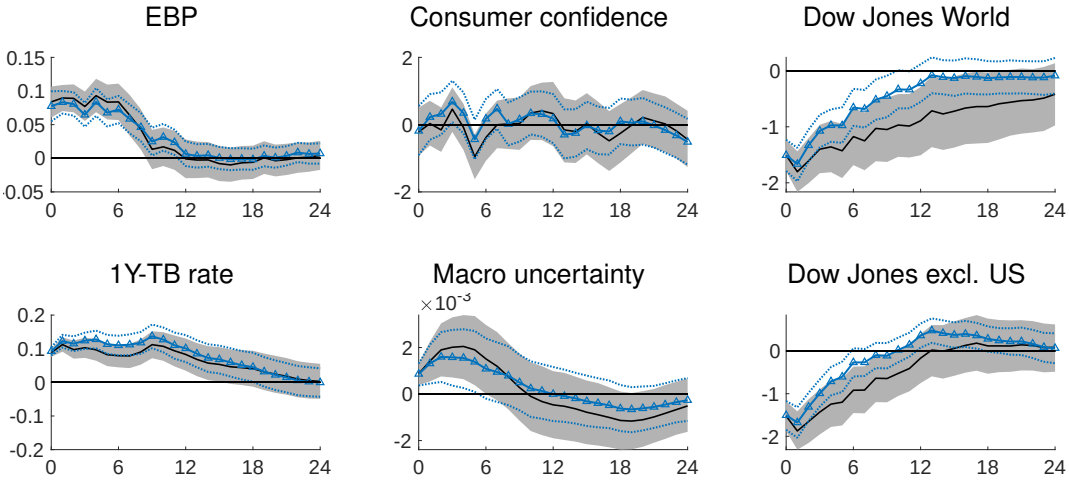
Only stock market wealth effects explain spillbacks to consumption



Are stock market wealth effects in consumption plausible?

HANK models resuscitate role of wealth effects in monetary policy transmission
Kaplan et al. (2018); Auclert (2019); Caramp and Silva (2020)

US household portfolios are exposed to stock markets

- $\sim$50% of US households hold equity, $\sim$25% of total assets direct/indirect holdings
  Bricker et al. (2019)
- Equity holdings quantitatively important for households across wealth distribution
  Christelis et al. (2013)
- Especially mutual fund shares and retirement accounts may be internationally diversified
  Christelis and Georgarakos (2013); Calvet et al. (2007)

Implied elasticity of consumption to stock market wealth

- Our estimates imply elasticity of consumption to equity prices of $\sim$10%
- At the upper end of the range of estimates in the literature
  Lettau et al. (2002); Lettau and Ludvigson (2004); Bjornland and Leitemo (2009)

Foreign equity accounts for 24-61% of total holdings of US residents, depending on definitions and accounting for stock market bubbles Details

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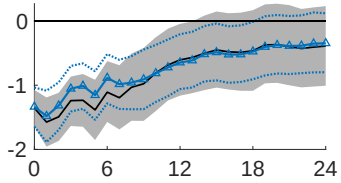
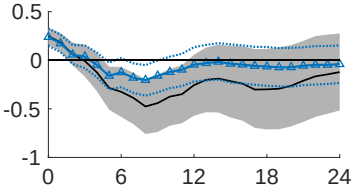
Tobin's q effects underpin spillbacks to investment

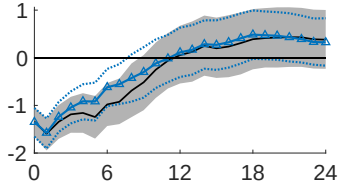
S&P 500



S&P 500 earnings expectations



S&P 500 low RoW exposure



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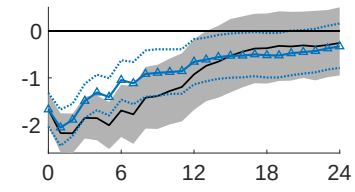
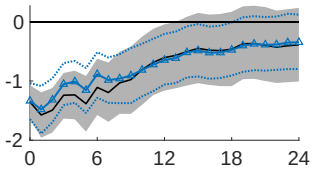


Are Tobin's q effects to investment plausible?

S&P 500



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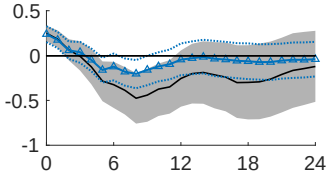

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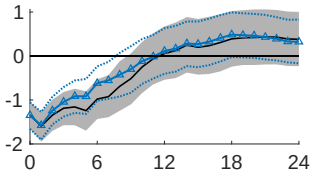

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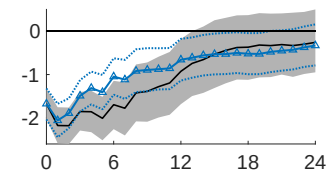
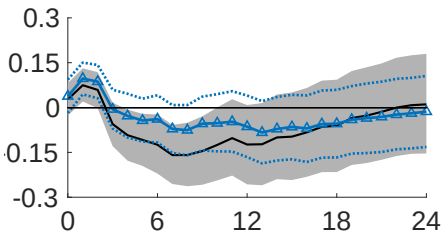


- S&P 500 firms strongly exposed to the RoW
- $>$40% (30%) of total sales (revenues) due to RoW

  Brzenk (2018); Silverblatt (2019)

Would US monetary policy be ineffective without spillbacks?

Baseline and counterfactual
US IP response



- Non-trivial posterior probability mass not below 0...
- ...but the greater mass below 0
- In any case: In the relevant counterfactual thought experiment spillbacks replaced by domestic channels (e.g. foreign by domestic revenues, foreign by domestic equity holdings)
- Spillbacks don't come *'on top'* but *'instead'* of domestic channels
- Its not '*if it wasn't for the RoW then*' but rather '*the actual domestic effect can be decomposed into*'

Which regions matter for spillbacks to US real activity?

Replace RoW by AE and EME industrial production, re-estimate, and then

1. Shut down spillbacks through both AEs and EMEs
2. Shut down spillbacks through AEs, but allow spillbacks through EMEs
3. Shut down spillbacks through EMEs, but allow spillbacks through AEs

Check if

2. closest to 1. $\Longrightarrow$ Spillbacks materialise through AEs
3. closest to 1. $\Longrightarrow$ Spillbacks materialise through EMEs

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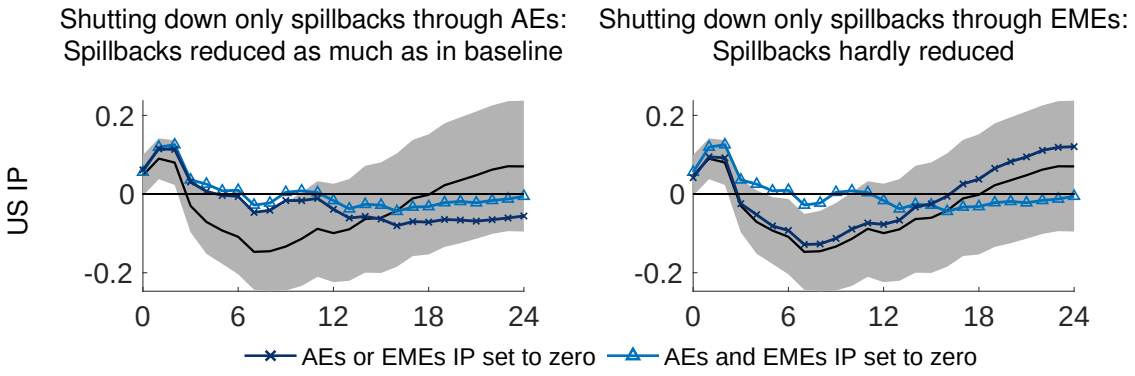
Spillbacks to US real activity arise through AEs and not EMEs



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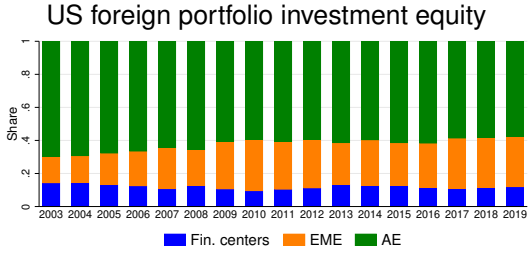

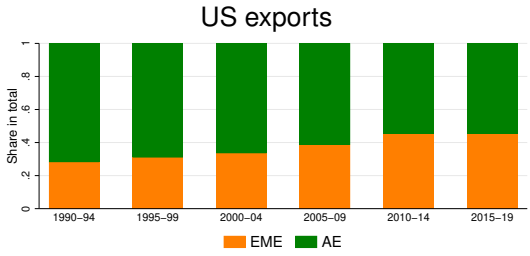

- Spillbacks materialise through AEs rather than EMEs
- Consistent with relative importance of AEs and EMEs in US overall real and financial integration
- Caveat: Reflects the average dynamics in the data over 1990 to 2019

Conclusion

- Large spillovers from US monetary policy
  Georgiadis (2016); Dedola et al. (2017); Iacoviello and Navarro (2019); Vicondoa (2019); Degasperi et al. (2020)
- Complaints from—especially EME—policymakers about externalities
  Eichengreen (2013); Rajan (2013, 2016a,b); Rey (2016)
- Fed claims spillovers are internalised due to spillbacks
  Fischer (2014); Yellen (2019)
- But essentially no work that documents the magnitude of spillbacks
- We find that spillbacks from US monetary policy
  - account for 50% of domestic real activity effects of US monetary policy
  - arise through stock market wealth/Tobin's q effects in US consumption and investment
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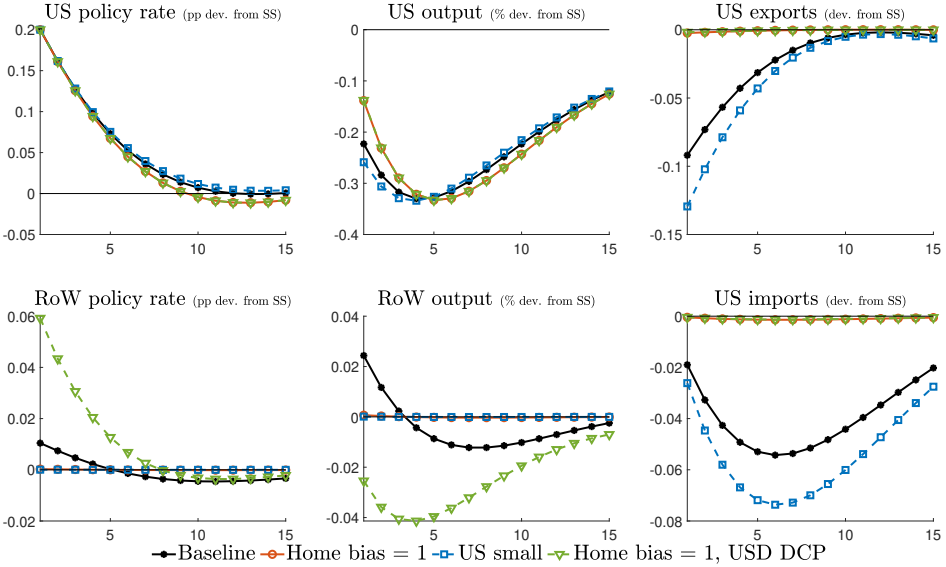
Spillbacks can be zero even if spillovers are not precluded



Return

Identification and estimation with multiple proxy variables

- Intuition: Unobserved structural shocks $\boldsymbol{\epsilon}_t$ drive observed proxy variables $\boldsymbol{m}_t$

$$\boldsymbol{m}_t = \boldsymbol{B}(L)\boldsymbol{m}_{t-1} + \boldsymbol{C}(L)\boldsymbol{y}_{t-1} + \boldsymbol{D}\boldsymbol{\epsilon}_t + \boldsymbol{\nu}_t \tag{1}$$

- Suppose we have two proxy variables $\boldsymbol{m}_t = (p_t^{\epsilon,mp}, p_t^{\epsilon,u})'$, then by assumption

$$E[\boldsymbol{m}_t(\epsilon_t^{mp}, \epsilon_t^{u})'] = \begin{pmatrix} E[p_t^{\epsilon,mp}\epsilon_t^{mp}] & E[p_t^{\epsilon,mp}\epsilon_t^{u}] \\ E[p_t^{\epsilon,u}\epsilon_t^{mp}] & E[p_t^{\epsilon,u}\epsilon_t^{u}] \end{pmatrix} = \boldsymbol{V}, \tag{2a}$$

$$E[\boldsymbol{m}_t(\boldsymbol{\epsilon}_t^{row\prime}, \boldsymbol{\epsilon}_t^{o\prime})'] = \begin{pmatrix} E[p_t^{\epsilon,mp}(\boldsymbol{\epsilon}_t^{row\prime}, \boldsymbol{\epsilon}_t^{o\prime})'] & E[p_t^{\epsilon,u}(\boldsymbol{\epsilon}_t^{row\prime}, \boldsymbol{\epsilon}_t^{o\prime})'] \end{pmatrix} = \boldsymbol{0}. \tag{2b}$$

The Bayesian proxy structural VAR model

- Structural shocks in the VAR model $\boldsymbol{A}(L)\mathbf{y}_t = \boldsymbol{\epsilon}_t$ are

$$\boldsymbol{\epsilon}_t = \left[\underset{4\times 1}{\boldsymbol{\epsilon}_t^{*\prime}} \quad \underset{n-4\times 1}{\boldsymbol{\epsilon}_t^{o\prime}} \right]^{\prime} = \left[\epsilon_t^{mp} \quad \epsilon_t^{u} \quad \underset{2\times 1}{\boldsymbol{\epsilon}_t^{row\prime}} \quad \underset{n-4\times 1}{\widetilde{\boldsymbol{\epsilon}}_t^{o\prime}} \right]^{\prime} \tag{3}$$

- Identification by combination of proxy variables, sign, zero and magnitude restrictions

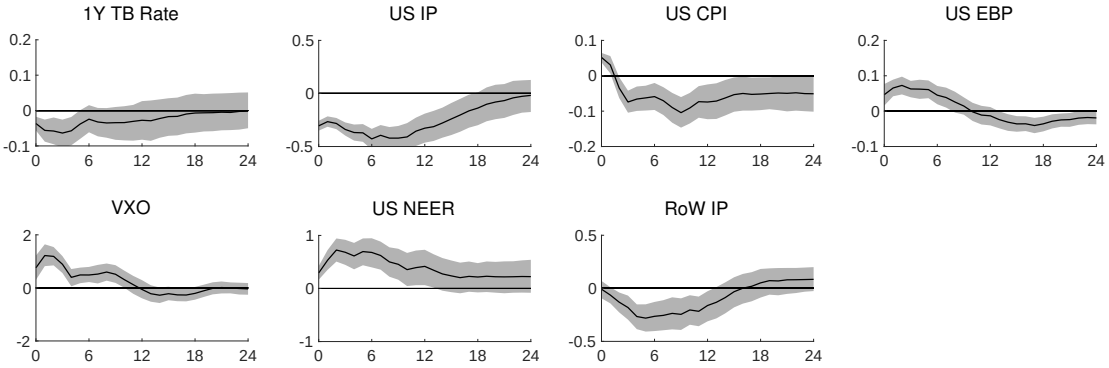
Identification implementation

- US monetary policy shock: Proxy based on high-frequency interest rate changes
  Gürkaynak et al. (2005); Gertler and Karadi (2015); Caldara and Herbst (2019); Jarocinski and Karadi (2020)
- Global uncertainty shock: Proxy based on high-frequency gold price changes
  Piffer and Podstawski (2018)
- Two RoW 'reduced-form' shocks that nest all RoW structural shocks

Variable / Shock	**RoW 'depreciating' shock**	**RoW 'appreciating' shock**
US 1-year T-bill rate		
US industrial production	$< 0^{\triangle}$	$\lozenge$
US CPI		
US excess bond premium		
US dollar NEER	> 0	< 0
VXO		
RoW industrial production	< 0 & $<^{\triangle}$	< 0 & $<^{\lozenge}$
US interest rate surprise	0	0
Gold price surprise	0	0

Return

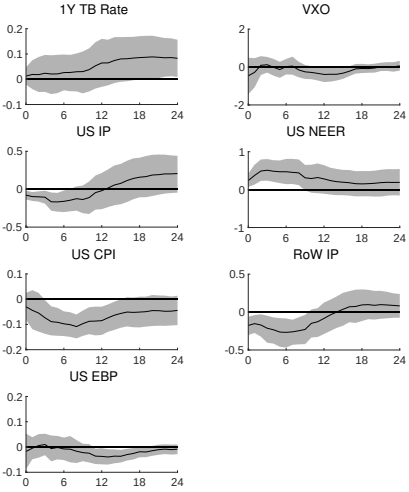
Baseline IRFs to global uncertainty shock



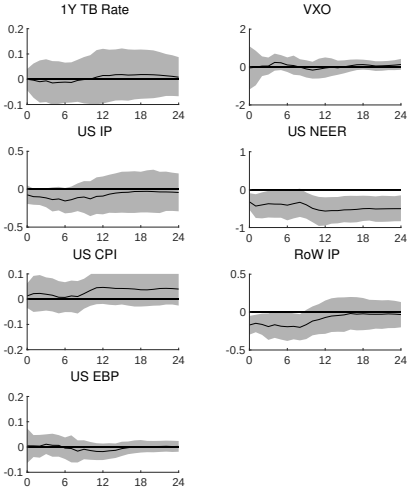
Return

Baseline IRFs to RoW shocks

RoW 'depreciating' shock

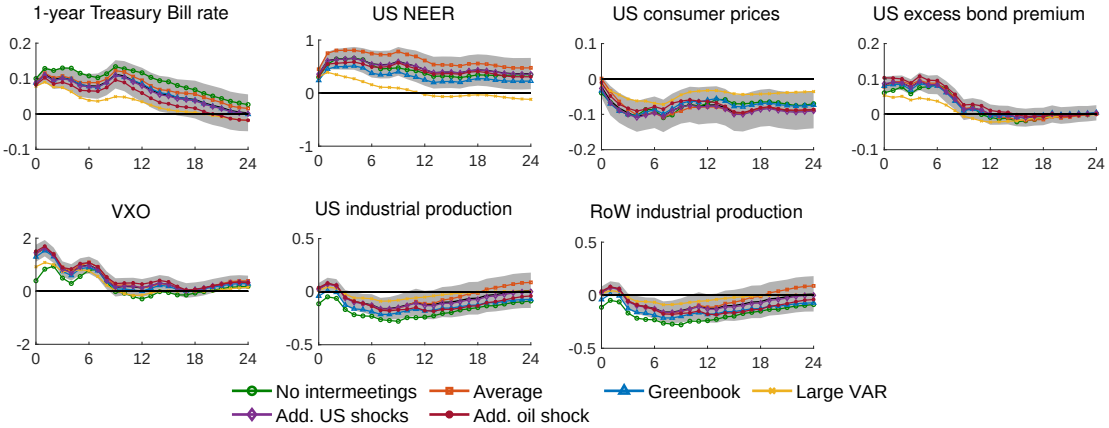


RoW 'appreciating' shock



Return

Robustness: IRFs to US monetary policy shock



Return

SSA intuition

- SSA used in less general framework based on IRFs so far
  Kilian and Lewis (2011); Bachmann and Sims (2012); Wong (2015); Epstein et al. (2019)

- In our paper: Think of **baseline IRF** as conditional forecast
  - US monetary policy shock occurs in $T+1$, zero thereafter: $\epsilon^{mp}_{T+1} = 1$, $\epsilon^{mp}_{T+h} = 0 \;\; \forall h > 0$
  - All other shocks zero: $\boldsymbol{\epsilon}^{row}_{T+h} = \mathbf{0}$, $\epsilon^{r}_{T+h} = 0$, $\widetilde{\boldsymbol{\epsilon}}^{o}_{T+h} = \mathbf{0} \;\; \forall h \geq 0$

- **Counterfactual IRF** is a **constrained** conditional forecast
  - RoW industrial production forecast satisfies $y^{ip^*}_{T+h} = 0 \;\; \forall h$
  - Achieved by materialisation of future shocks which offset impact of US monetary policy
  - Need to decide about the set of driving shocks

- Antolin-Diaz et al. (2021): How to implement constrained conditional forecast

Return

MRE intuition

- MRE so far used in forecasting to exploit additional, off-model information
  Cogley et al. (2005); Robertson et al. (2005); Giacomini and Ragusa (2014)
- We use it to construct counterfactual IRFs
- Posterior distribution of IRFs
  - Baseline

$$f(\boldsymbol{y}_{T+h}|\boldsymbol{y}_{1,T},\mathcal{I}_a,\boldsymbol{\epsilon}_{T+1,T+h}) \propto p(\boldsymbol{\psi}) \times \ell(\boldsymbol{y}_{1,T}|\boldsymbol{\psi},\mathcal{I}_a) \times \nu, \tag{4}$$

  - Counterfactual

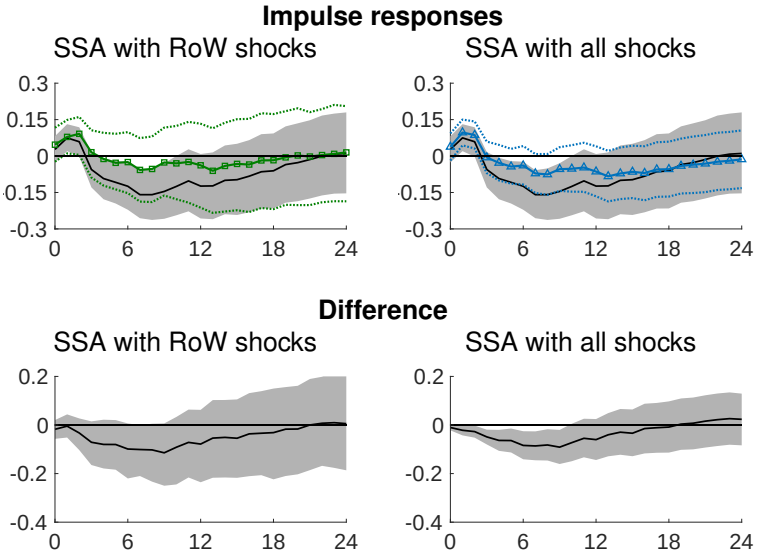
$$f^*\left(\widetilde{\boldsymbol{y}}_{T+h}|\boldsymbol{y}_{1,T},\mathcal{I}_a,\boldsymbol{\epsilon}_{T+1,T+h},\widetilde{y}^{ip^*}_{T+h}=0\right) \propto f(\widetilde{\boldsymbol{y}}_{T+h}|\boldsymbol{y}_{1,T},\mathcal{I}_a,\boldsymbol{\epsilon}_{T+1,T+h}) \times \tau\left(\widetilde{y}^{ip^*}_{T+h}(\boldsymbol{\psi})\right), \tag{5}$$

- Tilt $\tau(\cdot)$ determined such that Kullback-Leibler divergence $\mathcal{D}(f^*|f)$ is minimised:

  Find the counterfactual world which is as similar as possible to the actual world but in which $y^{ip^*}_{t+h}$ does not respond to ϵ^{mp}_t

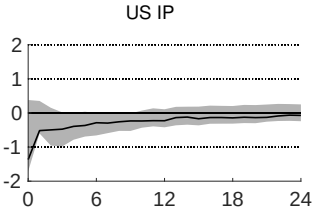
Return

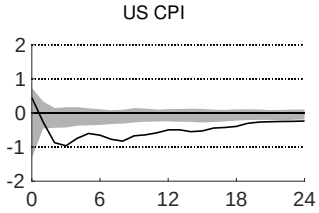
Difference between baseline IRFs and SSA counterfactuals



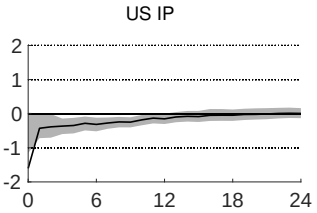
Modesty statistic of Leeper and Zha (2003) for US IP and CPI

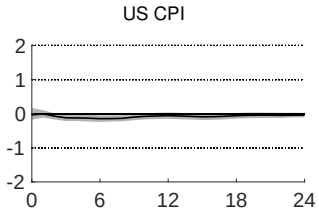
SSA with RoW shocks





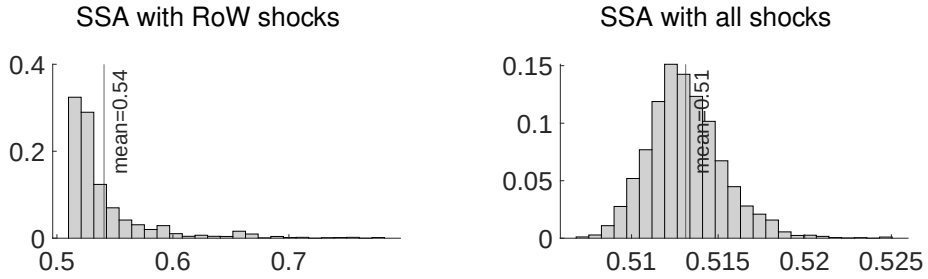
SSA with all shocks





Return

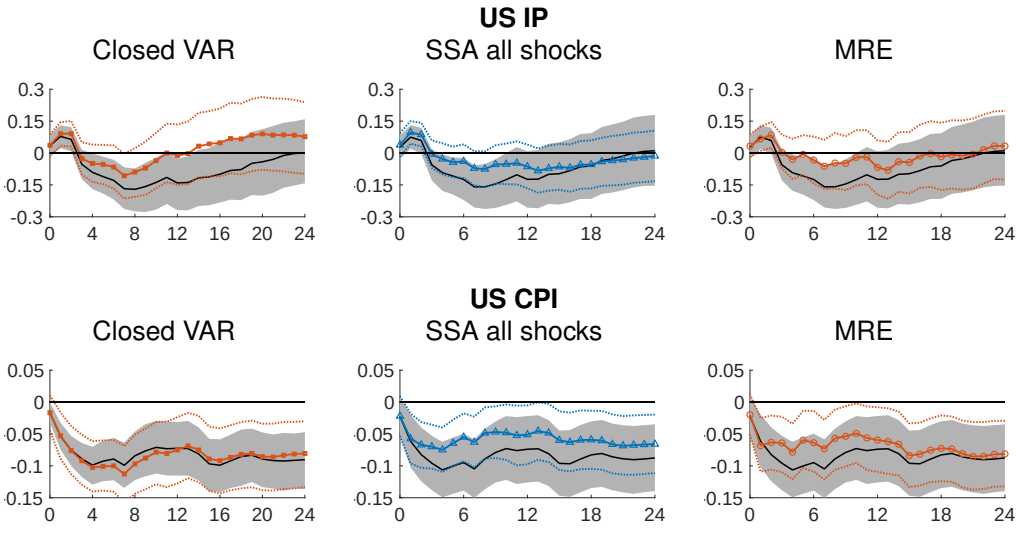
q-divergence of Antolin-Diaz et al. (2021)



Notes: The figure shows the distribution of the q-divergence of Antolin-Diaz et al. (2021) for the SSA; the left-hand side panel presents results for the case in which only the rest-of-the-world shocks are driving shocks, while the right-hand side panel for the case in which all shocks are used as driving shocks. The q-divergence indicates how unlikely a conditional forecast is in terms of comparing the implied distributions of shocks with their unconditional distributions, translated into a comparison of the binomial distributions of a fair and a biased coin.

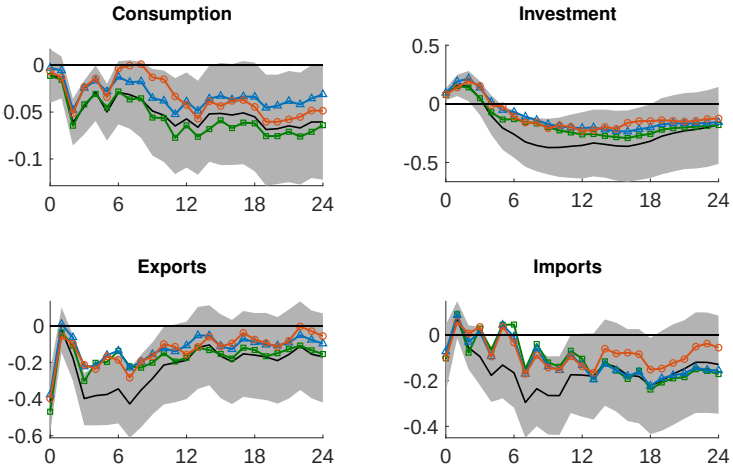
Return

Closed VAR results



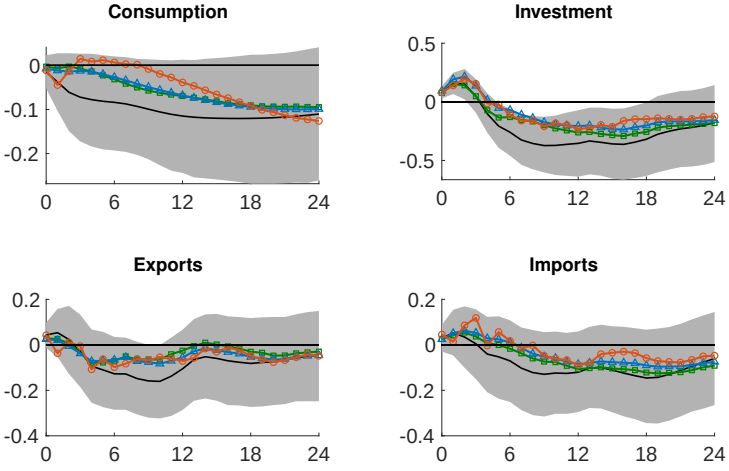
Return

US GDP components



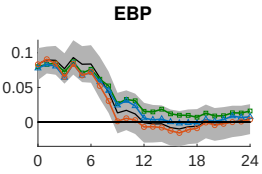
Return

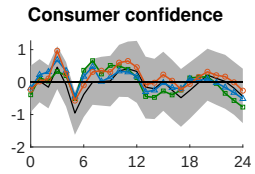
US GDP components (interpolated quarterly data)

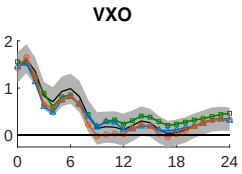


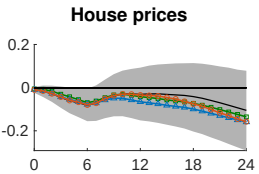
Return

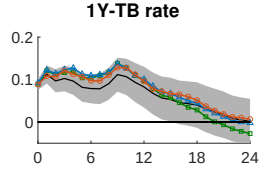
Weaker negative wealth/Tobin's q effects?

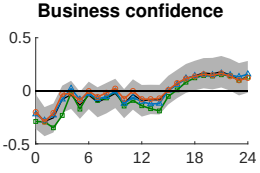


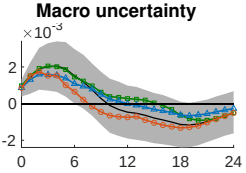


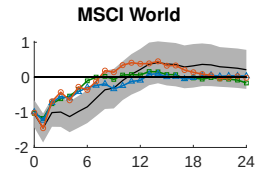






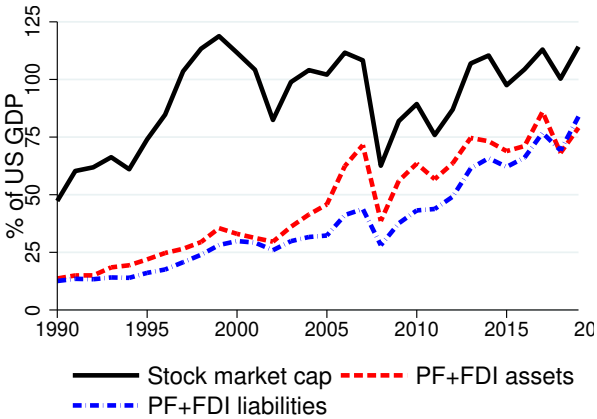




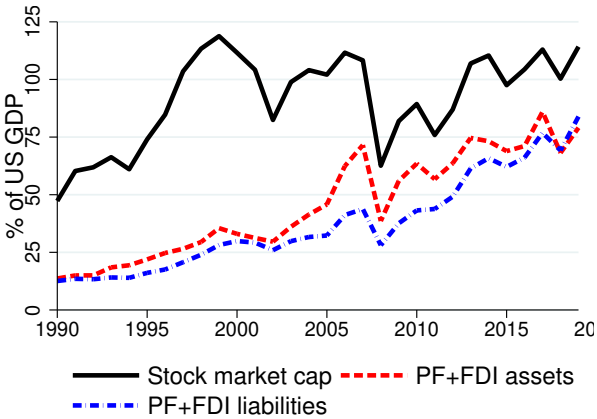


Return

Are wealth effects through foreign equity holdings plausible?



Are wealth effects through foreign equity holdings plausible?

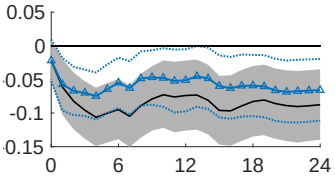


- Foreign equity accounts for 61% of total holdings of US residents since 2006
- Only PF: 34%; since 1990: between 46% (PF+FDI) and 24% (PF)
- Recall: US is 'world venture capitalist'
  Gourinchas and Rey (2007)
- Spillbacks through stock market wealth effects in RoW equity plausible

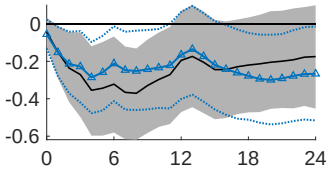
Return

How do the spillbacks to US consumer prices arise?

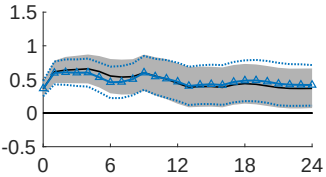
CPI



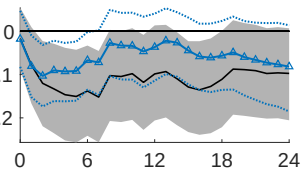
Import prices



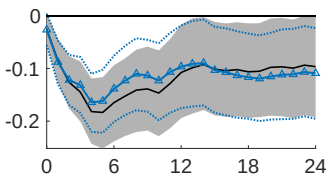
US dollar NEER



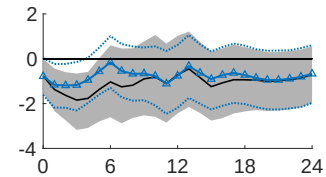
PPI (final products)



Import prices excl. petroleum



Oil prices



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